POLAR

Global Geospace Science Program: Polar Mission

Mission Objective

The objectives of the Global Geoscience (GGS) Polar and Wind missions are to: 1) characterize the energy input to the ionosphere; 2) determine the role of the ionosphere in substorm phenomena and in the overall magnetosphere energy balance; 3) measure complete plasma, energetic particles, and fields in high latitude polar regions, and the energy input through the dayside cusp; 4) provide global multispectral auroral images of the magnetospheric energy disposition into the ionosphere and upper atmosphere; and 5) determine characteristics of ionsopheric plasma outflow.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
SPACE PHYSICS	SPACE SCIENCE	GSFC	HYBRID	GE	GE

Payload Description

The Polar Plasma Laboratory (POLAR) carries a complement of ten instruments that provide measurements to aid in the study of magnetic fields, thermal ion dynamics, ion masses, plasma waves, electric fields, polar ionospheric x-ray images, energetic particle distributions, charge and mass magnetospheric ion compositions, fast plasmas, and optical auroral images. The POLAR spacecraft utilizes, as much as possible, common off-the-shelf subsystems of proven design. The power subsystem consists of solar arrays, batteries and power distribution. The command equipment receives, processes and executes real-time commands as well as commands from on-board command storage. The C&DH subsystems collects, formats, and records science and engineering data. The spacecraft is spin stabilized, utilizing an open-loop system consisting of Earth sensors, Sun sensors and Star sensors. Liquid-propellant propulsion is used for orbit and attitude maneuvers.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
CHARGE & MAGNETOSPHERIC ION COMPOSITION EXPERIMENT	CAMMICE	LANL	T. FRITZ	LANL
COMPREHENSIVE ENERGETIC PARTICLE PITCH ANGLE DISTR	CEPPAD/SEPS	AEROSPACE	B. BLAKE	AEROSPACE/LANL/ LOCKHEED
ELECTRIC FIELDS INSTRUMENT	EFI	UCB	F. MOZER	UCB
FAST PLASMA ANALYZER	HYDRA	UNIV IOWA	J. SCUDDER	GSFC
MAGNETIC FIELDS EXPERIMENT	MFE	UCLA	C. RUSSELL	UCLA
PLASMA WAVE INSTRUMENT	PWI	UNIV IOWA	D. GURNETT	UNIV IOWA
POLAR IONOSPHERIC X-RAY IMAGING EXPERIMENT	PIXIE	LPARL	W. IMHOF	AEROSPACE/ LOCKHEED
THERMAL ION DYNAMICS EXPERIMENT	TIDE/PSI	MSFC	T. MOORE	MSFC
TORODIAL ION MASS ANGLE SPECTROGRAPH	TIMAS	LPARL	E. SHELLEY	LOCKHEED
ULTRAVIOLET IMAGER	UVI	UNIV WASH.	PARKS	MSFC
VISIBLE IMAGING SYSTEM	VIS	UNIV IOWA	L. FRANK	UNIV IOWA

Instrument Descriptions
The POLAR Charge and Magnetospheric Ion Composition Experiment (CAMMICE), Data Point 678, is designed to determine the composition of the earth's plasma populations, their original sources, and the mechanisms which energize and transport these populations. The instrument incorporates two sensor systems, each of which performs a three-parameter measurement on the ion composition for elements from H through Fe. Each of the sensor systems is supported by its own data processing unit.
The POLAR Comprehensive Energetic Particle Pitch Angle Distribution/Source/Loss Cone Energetic Particle Spectrometer (CEPPAD/SEPS), Data Point 676, provides detailed pitch angle measurements of energetic particle fluxes over wide ranges of particle energy spectra, identifies separate ions and electrons, and gives information on high energy ion composition. The instrument consists of three body-mounted sensors and three sensors mounted on a scan platform, with all sensors controlled by microprocessors.
The POLAR Electric Fields Instrument (EFI), Data Point 683, is designed to study electric fields alone and in concert with other POLAR instruments to provide electric field comparisons at different points along the same magnetic field line, at different points along a common boundary, or in different regions of the magnetosphere. The instrument consists of three orthogonal double probes each of which is a pair of separated conducters whose potential difference is measured.
The POLAR Fast Plasma Analyzer (HYDRA), Data Point 682, is designed to provide rapid.very low energy measurement of three-dimensional ion and electron distribution functions as a tool for analyzing the earth's high-latitude magnetosphere on both macrospace and microspace scales. The instrument consists of six pairs of body-mounted sensors and two pairs of platform mounted sensors.
The POLAR Magnetic Fields Experiment (MFE), Data Point 684, is designed to make high precision measurements of the magnetic field in the high and low altitude polar magnetosphere. The instrument consists of dual triaxial magnetometers with flippers. Dual microprocessors and random access memory are used to process the data so that the data sent to earth are immediately useable by investigators without extensive supporting calculations.
The POLAR Plasma Wave Instrument (PWI), Data Point 680, is designed to measure the spectrum, amplitude, and wave vector characteristics for naturally occurring electromagnetic and electrostatic plasma waves. Unique features of the instrument are the capability to recognize the presence of a desired phenomenon based on on-board microprocessor algorithms and to capture the waveforms for six wave fields simultaneously.
The POLAR Polar Ionospheric X-ray Imaging Experiment (PIXIE), Data Point 679, measures spatial distribution and temporal variations of X-ray emissions from the earth's atmosphere. The instrument includes a multiple pinhole camera with a position-sensitive multiwire-proportional-counter detector. The associated signal processing and digital electronics identifies X-ray events (interaction vs. non-interaction), locates the events in three-dimensional space, and determines the X-ray energy.
The POLAR Thermal Ion Dynamics Experiment/ Plasma Source Instrument (TIDE/PSI), Data Point 674, is designed to study the origin, transport, energization, storage, and loss of low energy ions in the earth's magnetosphere. A complete distribution of ions is obtained over each spin of the spacecraft. The instrument consists of two sensor assemblies mounted on opposite edges of the spacecraft and an electronics assembly.
The POLAR Toroidal Ion Mass Angle Spectrograph (TIMAS), Data Point 681, is designed to provide the properties, location, and morphology of the principal source region for the entry of solar wind plasma (i.e., the polar cusp) and for the hot ionospheric plasma (i.e., the auroral acceleration region) in the magnetosphere. It also identifies various processes associated with source plasmas, such as those by which relatively cool source plasma are energized into hot magnetospheric plasma.
The POLAR Ultraviolet Imager (UVI) is an ultraviolet imaging camera designed to obtain global images of the aurora at several wavelengths. The UVI utilizes two ultraviolet optical channels, one in the near ultraviolet and one in the vacuum ultraviolet. The UVI includes primary and secondary optics, electromechanical devices for mirror and aperture control and for filter selection, optical filters and image-intensified CCD-sensor arrays with themoelectric cooling.
The POLAR Visible Imaging System (VIS), Data Point 675, combines two units: 1) a UV Imager provided by the NASA Marshall Space Flight Center and 2) a Visual Imager provided by the University of Iowa. The UV Imager obtains global images of the aurora at several wavelengths with a time resolution of one minute. The Visible Imager obtains global images of the aurora at performance specifications identical to the UV Imager except for capturing images in the visible rather than ultraviolet wavelengths.

Launch
11/1/94(W) 11/21/95(P)